

**CASTING OF SUPERCONDUCTING COMPOSITE MATERIALS
M-4**

**Kazumasa Togano
National Research Institute for Metals
Tsukuba, Japan**

An aluminum-lead-bismuth alloy is a flexible alloy and is promising for easily workable embedded-type, filament-dispersed superconducting wire material. It is difficult to produce homogeneous ingots of this material because it is easily separated into elements when melted on Earth due to the large specific gravity differences.

In this experiment, a homogeneous alloy will first be produced in molten state in microgravity. It will then be returned to Earth and processed into a wire or tape form. It will then be dispersed as the second phase in micro texture form into the primary phase of aluminum.

Superconducting wire material with high-critical-magnetic-field characteristics will be produced. The texture of the material will be observed, and its performance will be evaluated.

In addition to the above alloy, a four-element alloy will be produced from silver, a rare Earth element, barium, and copper. The alloys will be oxidized and drawn into wire after being returned to Earth. The materials are expected to be forerunners in obtaining superconducting wire materials from oxide superconductors.

The objectives of this experiment are as follows:

- To study the effects of microgravity on the solidification phenomena of monotectic and eutectic alloys.
- To form composite superconductors from the alloys.

MATERIALS

Monotectic Alloys

Al-Pb-Bi 3

Eutectic Alloys

Ag-Cu 1

Ag-Y-Ba-Cu 1

Ag-Yb-Ba-Cu 1

CRUCIBLE

Baron Nitride

CAPSULES

Ta Double Layers

CARTRIDGE Ta

FURNACE

CHF

1300 °C x 17 min, gas jet cooling

POST-FLIGHT EXPERIMENTS

ANALYSES

Monotectic Alloys

Pb-Bi Particle Distribution in Al Matrix

Eutectic Alloys

Lamellar Spacing

FORMATION OF COMPOSITE SUPERCONDUCTORS

Deformation of Al-Pb-Bi Alloy into Wire with Fine Distribution of Pb-Bi Superconducting Fibers in Al Matrix

Oxidation of Ag-Yb(Y)-Ba-Cu Alloy to Form YBaCuO HTSC Precipitates in Ag Matrix

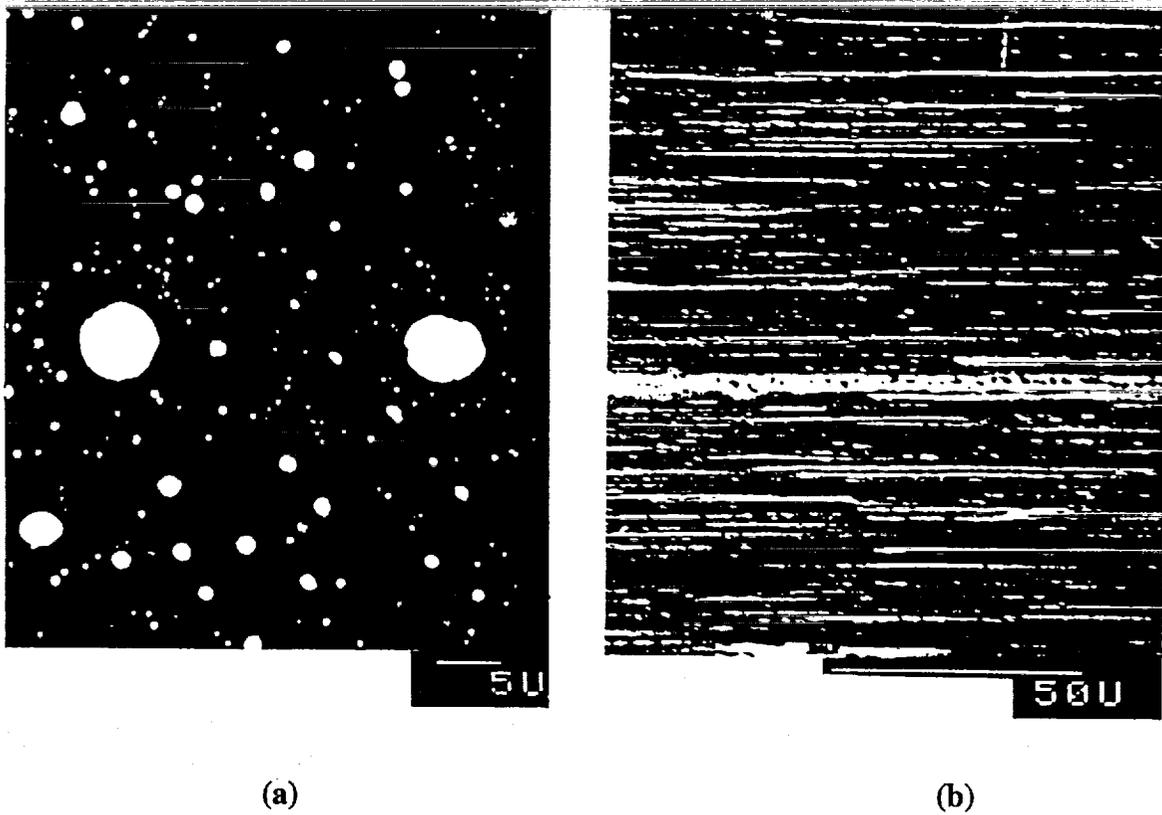


Figure 1. M-4 casting of superconducting composite materials: (a) microphotograph of Al-Pb-Bi as-cast ingot and (b) microphotograph of wire made by deforming the ingot.

FURNACE

TEM-01

AL-PB-BI ALLOY

BORON NITRIDE CRUCIBLE

NICKEL CARTRIDGE

(a) UNDER NORMAL GRAVITY

(b) UNDER LOW GRAVITY

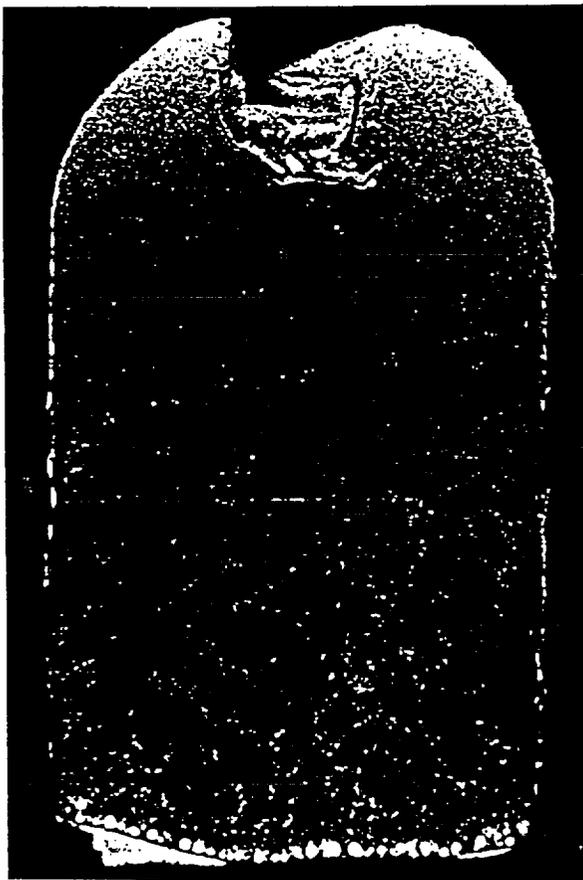


Figure 2. TEXUS 13 (1986) sounding rocket.

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